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ABSTRACT

Literature has indicated that computers have a potential to support children in all stages of development. To enhance children's learning through technology, it is important to understand how children use computers. This study explores the use of interactive multimedia by three- to five-year olds. Through a close examination of the young children's verbal and facial expressions, their use of the mouse, their body movement, and their attitudes toward multimedia as well as their teachers' comments, this study showed that multimedia technology with its use of video, audio, and graphics could engage children at a longer period of time. The children demonstrated a great interest in using the technology and had little difficulty in adjusting to the new learning environment. Although many children were exposed to the technology for the first time, it was obvious that these children were ready for the technology. The results also indicated that using developmentally appropriate materials and allowing children to have control of the program are important factors to keep them interested. Implications for multimedia software design based upon the findings of the study are also discussed. Eight figures and tables present sample video clips and activities; a breakdown of time on activities spent by age and ability levels; a summary of the children's verbal expressions; use of the mouse; and how children like the program. (Contains 19 references.) (Author)

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ED 396 713

# An Exploratory Study of How Pre-kindergarten Children Use the Interactive Multimedia Technology: Implications for Multimedia Software Design

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RUNNING HEAD: Interactive Multimedia in Early Childhood

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**Abstract**
(182 words)

Literature has indicated that computers have a potential to support children in all stages of development. To enhance children's learning through technology, it is important to understand how children use computers. This study explores the use of interactive multimedia by three-to five-year olds. Through a close examination of the young children's verbal and facial expressions, their use of mouse, their body movement, and their attitudes toward multimedia as well as their teachers' comments, this study showed that multimedia technology with its use of video, audio, and graphics could engage children at a longer period of time. The children demonstrated a great interest in using the technology and had little difficulty in adjusting to the new learning environment. Although many children were exposed to the technology for the first time, it was obvious that these children were ready for the technology. The results also indicated that using developmentally appropriate materials and allowing children to have control of the program are important factors to keep them interested. Implications for multimedia software design based upon the findings of the study are also discussed.

**Research Framework**

Interactive multimedia technology is a recent development in computer industry. Its use of different media -- audio, video, text, graphics and animation in one program -- and its power of linking various concepts in a nonlinear manner exhibit a tremendous potential for enhancing learning (Nelson, 1994). With the capability of creating a more realistic learning context through its different media and allowing a learner to take control, interactive multimedia can provide an effective learning environment to different kinds of learners. Since presenting real world objects and exercising all senses through interaction is crucial for children's development, interactive multimedia environment can be especially beneficial.

When we examine the impact of this new multimedia technology on early childhood education, we should take a look at the current literature on computer use for young children. While there were earlier concerns of computers being too abstract and hard for young children (Goodwin, Goodwin, Nansel, & Helm, 1986; Simon, 1985; Smithy-Willis, Riley, & Smith, 1982), many educators now believe that computers can be used in early childhood education if they are used appropriately (Alloway, 1994; Clements & Nastasi, 1993; Guddemi & Fite, 1991; Shade, Nida, Lipinski, & Watson, 1986; Wright, Shade, Thouvenelle, & Davidson, 1989). In fact, computers are seen as just another enrichment option for exploration and manipulation. In a study by Guddemi and Fite, 91 percent of the parents and 80 percent of the teachers surveyed thought computers were appropriate for children as young as three to five year olds. The ratio of computers to students has changed from 1:125 in 1984 to 1:22 in 1990 (Clements & Nastasi).

Much of the discussion on computer use in early childhood centers on whether computers can help the development of language, motor skills, social-emotional, and cognitive growth of children. Educators believe that computers can enrich learning by providing another playful dimension utilizing young children's five senses (Shade, Nida, Lipinski, & Watson, 1986). Wright (1994) points out that what children are doing on the computer is similar to children's normal play in becoming more fluent in using various

symbols, including gestures, pictures, and words. "Their verbal, intrapersonal, interpersonal, and visual intelligences blend in unique ways to form their own unique modes of expression" (Wright, p. 9). Computer graphics programs are seen to be capable of enhancing language development and encouraging verbal expression as children create and often narrate what appears on the screen (Wright, Shade, Thouvenelle, & Davidson, 1989). Research shows that computer-generated graphics can assist young children in developing symbolic representations, an important aspect of cognition in early childhood (Escobedo & Bhargava, 1991). Studies have also found that young children can successfully use computers for word processing in emerging literacy programs (Guddemi, 1987; Guddemi & Fite, 1991). Children who write more often with computers, as their skills advance, are likely to take increased pride and confidence in their writing. They have fewer fine motor control problems and are more willing to take risks and revise. Computers can help to build a sense of competence (Clements, 1992).

The use of keyboards calls for precision and careful hand motions. This increases awareness of cause and effect so as not to hit more than one key or hold one down for too long (Wright et al., 1989). Controlling a mouse or a joystick adds a degree of precision. Literature has suggested that fine motor skills can be heightened through the use of a keyboard, mouse, joystick, or touch window (Wright et al.) and children can use various input devices fairly well (Alloway, 1994).

Increasingly, collaborative learning environment has been emphasized where children not only learn from computers, but also learn from each other while playing at computers. King and Alloway (1992) found that young children showed pro-social behaviors when working on computers and increased their concentration spans in interacting with computers with each other. In arguing that computers can function as a medium for joint activity, Crook (1992) described how computers helped children to get engaged in collaborative problem-solving activities. Computers are also seen to be tools to increase children's self-esteem and attitudes. Knowing how to use computers often make children feel good about themselves.

**Rationale and Purpose of the Study**

Literature has indicated that computers can support children in all stages of development. Interactive multimedia, with its capability of presenting a learning environment that is closer to what children are familiar with, should assist young children more effectively in their language, motor skills, social, emotional, and cognitive development. Computer knowledge has become an important part of learning for today's children, who are the workforce of the 21st-century (Thouvenelle, Borunda, & McDowell, 1994). Computer skills are not only desirable but also essential. Recently we have seen more multimedia CD-ROMs and videodiscs on the market than in the past 20 years. It is predicted that the development of multimedia titles will increase at a tremendous speed in the next five years. A large number of such multimedia software will be targeted at young children. Due to rapid increase in multimedia software and decrease in hardware and software costs, more and more children have access to interactive multimedia technology at school and at home.

Multimedia is not only readily accessible, but technological advances also allow us to produce multimedia materials more easily. Even non-programmers are able to develop their own applications from available authoring programs. An increasing number of teacher education programs require teachers to be proficient in using computers and encourage preservice and inservice teachers to construct their own curriculum-appropriate programs for classroom use. However, in order to ensure the high educational value of the software and assist children's development through this new technology, educators must address the basic questions such as at what age level this new technology can be introduced and how to design developmentally appropriate software that facilitates children's learning.

The present study was undertaken to understand how pre-kindergarten children use the interactive multimedia technology. The specific research questions that guided this study were: (1) How do pre-kindergarten children respond to interactive multimedia technology?, (2) What are their attitudes toward using this new technology?, (3) How do they perform in learning the concepts of spatial relationships using the technology?, and (4) what are the

important factors for designing children's multimedia software? It attempts to address the issue of developmental appropriateness of the new technology for young children and identify factors that are important for multimedia software design.

## Method

### Participants

Children at the ages of three to five in a daycare center of a Southwestern city were solicited to participate in this study. There were two classes of this age at the daycare, a total of 19 children. All children were asked to participate. Parents of 11 children signed the consent forms to allow their children to take part. One child from a different daycare center volunteered. As a result, a total of 12 children participated. Five were boys, and seven were girls. The age of the children ranged from 3 years and 4 months (3:4) to five years and 1 month (5:1) with an average of 53.58 months (approximately 4:5). Two were three years of age, eight were four years of age and two just turned five.

The children in this daycare were from mid- to low-income families and 25 percent of the student population was non-white. The daycare had a curriculum of various topics for this group of children, including language, social skills, motor skills, and cognitive skills. It had a weekly gymnastic class to those who wanted to participate at an additional cost. Field trips were also a part of the curriculum. However, there were not any computers in the classrooms. Teachers of the classes participating in this study had no computer knowledge.

Of those 12 participating children, 58 percent (N=7) did not know what a computer was and had no computer at home. Eight percent (N=1) knew what a computer was, but did not have a computer at home. Twenty-five percent (N=3) knew what a computer was and had a computer at home. Eight percent (N=1) knew what is computer, had a computer at home as well as at the school (the child participating in this study from a different daycare center). These children were classified by their teachers according to their abilities and motor skills into low, medium and high groups: N = 1 in low group, N= 5 in medium group, and N = 6 in high group.

**The interactive videodisc program**

In an attempt to address how young children use multimedia, a HyperCard-based program was developed using the videodisc The Jungle Book to teach the concepts of spatial relationships to the preschoolers. The spatial relationship is a topic addressed in the curriculum for this age level. This program was developed by an inservice teacher to use in the early childhood classroom.

Using the videodisc, four paired topics (up/down, in/out, front/behind, and above/below) were presented through one of the children's favorite stories The Jungle Book. Various media such as text, graphics, audio, and video were used in the program. Upon opening the program, a child was presented with an instructional card giving information about the various icons used in the program (see Figure 1). For example, when a child clicked on the hand pointing to the right, the explanation of this icon was given orally. This instructional card was followed by a main menu with four options representing the four pairs of concepts and a picture of Bagheera, who was a black talking panther and a main character in the story (see Figure 2). The picture of Bagheera was a symbol of help and appeared on all the cards. Clicking on Bagheera, a child received oral directions on how to proceed. A child could select any of the four concepts to begin the activities.

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Insert Figure 1 here.

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Insert Figure 2 here.

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Four video clips were selected from The Jungle Book to illustrate each of the four spatial relationship concepts. If the child chose "up/down," for example, he or she could view two different scenes from the movie illustrating "up" and two different scenes illustrating "down" (see Figure 3). The child could view a movie scene as many times as he

or she would like. When he or she was ready, the child could proceed to the practice activity. On the practice card, two color pictures were displayed representing an example of "up" and a counter example, not "up" (see Figure 4). A click on Bagheera would give the audio of the question as to which picture represented the "up" movement. If the child selected the picture showing the direction "up," the word "up" would flash above the picture and a voice would say "Up! Here the elephant's trunk is up" (see Figure 4). Text and audio were used here to reinforce the concept.

Bagheera was used in the program as a friendly, familiar character and a consistent symbol to provide help. All four concepts were presented in a similar fashion: video instruction followed by a practice activity. All icon symbols were used consistently and placed in the same place. For example, the picture of Bagheera representing help was always at the lower center part of the screen. Text on activity cards always appeared above the pictures. The navigation buttons were always placed at the lower left and right corners of the screen. Because the target audience was preschoolers, the spatial relationship concepts were presented through video and color graphics, rather than the text. Text was used minimally. Directions and feedback were given orally. Music from the story was used as a motivation device in the beginning of the program. The hot spots (buttons) on the screens were purposely designed to be big, covering approximately 1/4 of the screen so that the young children, with limited motor skill, could easily locate and select them. Children could concentrate on learning the spatial relationships by interacting with the computer at their own pace and through their own control.

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Insert Figure 3 here.

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Insert Figure 4 here.

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**Data Sources**

This study is descriptive in nature and has three data sources: (1) observational data; (2) interviews with children; and (3) interviews with the teachers. Observations were made during children's use of the program and in the following categories: (a) the length of the time they were engaged in using the program; (b) facial expressions; (c) verbal expressions; (d) use of mouse; and (e) body movement. Detailed field-notes were written after each child used the program. After the use of the program, each child was interviewed. Children were asked questions such as "do you like to use this program," "which part is your favorite," and "if you are asked to work on this program again, would you like to."

The teachers of these two participating classes were also interviewed. The interview questions were about the curricular activities for this age group at the daycare, the children and their motor skills, and the teachers' perception on computer use in early childhood education. The teachers were also asked to look through the observational transcripts to see if there were any major discrepancies with their understanding of the children.

**Procedure**

The study was carried out during the normal operation hours of the daycare center. At the suggestion of the teachers, a computer with a videodisc player was set up in a room separated from the regular classrooms. During the time that did not conflict with their normal activities such as circle time, outdoor play time, nap time, meal and snack time, one of the 12 children was brought to the room where the equipment was set up to use the program at his/her own pace. The study was done over a ten-day period to avoid any interruption of the daycare's normal curriculum activities.

Since children at this age have very short attention span, two activities were used instead of all four spatial relationship concept activities. The two used were up/down and in/out. Before the child used the program, he or she was asked to recognize the equipment (the computer) and whether he or she had one at home. Then the child was asked to recognize the words such as "in," "out," "up," and "down." The four words were written on paper in

large print and shown to the child in a flash card fashion. None of the children (except child # 12) recognized the four words --"in," "out," "up," and "down." Child #12 proved to be able to read already and recognized all four words. He was then shown the words "in front" and "behind" which he did not recognize.

Then the child was shown how to use the mouse, how to watch for the cursor on the screen and how to click. An observer sat beside each child and recorded his or her use of the program according to the five categories mentioned above. The observer and the child worked on the instructional card together to ensure the child had understood how to use the program. Then the child went on using the program independently. The observer was available to answer any questions a child had and helped a child if he or she was stuck. After the child used the program, he or she was asked to recognize the four words again using the same "flash cards." The child was then interviewed.

## Results

### How Do Pre-K Children Respond to Interactive Multimedia

**Time Spent.** The time that each child spent using the program was recorded (see Table 1). As it was shown in Table 1, those children in the high ability group spent a little less time in completing the program than the children in the low and medium groups. Since children had the control of what to click and view and how many times they watched the video clips, the time each child spent was different from each other. Child # 11 and # 12, though both spent the same time, represented two extreme cases. Child #11, though in the high level group, exhibited more impatience in use than any of the other children. He chose to view all the video clips only once. It seemed that he just wanted to go to the end of the program. At times, he looked absent-minded. He responded incorrectly to all questions on practice activities. However, child #12 showed that he could already read to some extent. He finished the two assigned activities and wanted to do more. Therefore, within the reported 20 minutes, he finished three activities, one extra than the other children. He responded correctly to all questions. In the medium group, girls spent an average of 27 minutes, and boys spent

an average of 29.5 minutes. By comparison, girls of the high group spent, on the average, 26.67 minutes, and the boys spent 21.67 minutes on the average.

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Insert Table 1 here.

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**Verbal and Facial Expressions**. During their use of the program, these children made various verbal comments. Some children were very verbal and talked a lot while others were more quiet. Table 2 summarized various verbal expressions these children made. The findings showed that 83 percent of the children (N=10) immediately recognized the story as The Jungle Book and were excited to see it (see Table 2). After a brief introduction of how to use the program through the instructional card, children were asked to use the program on their own. Sixty-seven percent of the children (N=8) expressed various forms of understanding of how to proceed (see Table 2) while 33 percent (N=4) shook their heads, indicating that they needed help. The children gained their confidence in using the program, which was exhibited in the various expressions they made throughout the use (see Table 2). They also showed their fondness of the program. As Table 2 indicated, some children became quite curious and asked questions related to the program while two other children were absent-minded at one point and asked questions that had nothing to do with the program. It was worth pointing out that a couple of the children became frustrated at the video clips as the clips appeared to be too short for them (see Table 2). Some children did not understand that clicking on the same button would play the same video clip.

The majority of the children (75%) smiled, laughed, and giggled during watching various video clips. They looked happy when using the program, especially when watching the movie. The girl in the low ability group was very quiet but smiled most of the time. A boy in the medium group (child # 2) and a boy in the high ability group (child # 11) had little facial expressions on their faces during the entire time. Occasionally, there was an absent-

minded look on the face of child #11, and he even looked puzzled at times. When he was asked if he had any questions, he shook his head.

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Insert Table 2 here.

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**Mouse Use and Body Movement**. The children who have computers at home (child #2, #5, #11, #12) could use the mouse very well, with the correct holding position. They did not have any difficulty in moving the mouse onto the buttons and clicking. The girl in the low ability group, on the other hand, was very slow in getting used to the mouse. She used both hands and had a difficult time in holding the mouse and moving it onto a button. She needed the guidance from beginning to the end. She also needed prompts from the observer most of the time. What was most interesting was the use of the mouse among those children who encountered the computer for the first time. These children had no prior computer knowledge and could not recognize a computer when asked initially. However, most of them were ready to use the mouse, had little difficulty in coordinating their eye-and-hand movement, and could click on a button easily (see Table 3).

Most children sat while using the program. One preferred to stand. At the beginning of their use, several children intuitively stood up and touched the screen in response to the program's prompts. The movie clips were displayed on a TV monitor, separate from the computer screen. When they heard the clicking sound from the videodisc player, they quickly switched their attention to the TV monitor. When the movie stopped, they looked back at the computer screen. Several children including both boys and girls moved their bodies to the music on several occasions. Some showed their excitement when watching the movie. One boy (child # 3) stood up and put his ear close to the computer to listen. It appeared that audio from the computer was too low for him. One boy (child # 12) tapped his feet to the music and moved his hands up and down. Child # 11, however, had a difficult time concentrating. He looked impatient at times and could not sit still.

Insert Table 3 here.

**What Are Children's Attitudes Toward Interactive Multimedia**

When the children were asked about their opinions of the program, all said that they enjoyed using the program and would like to participate in using a similar program again. Three children asked when they could try it again. During the time when the study was carried out, children were excited and eager to go to the room where the equipment was set up. Two children, whose parents initially did not send in their consent forms, were particularly anxious to use the program and kept asking when their turn was. Upon seeing the eagerness of the children, the teacher called their parents to explain the situation and get their consent. When they were asked which part was their favorite, 57 percent of the children's responses indicated that watching the movie and characters of the movie (Bagheera and Mowgli) were their favorites (see Table 4). Twenty-nine percent of their responses showed that using computers was their favorite part.

Insert Table 4 here.

Except for child # 11, who viewed the video clip only one time, all children viewed the video clips more than once. Many of them looked at the clips three or four times. The children particularly liked a scene about Bagheera and Mowgli playing together and watched multiple times.

**How Do They Perform In Learning Using the Technology**

The purpose of the practice activities was to help children exercise what they just viewed in the movie and identify the relevant spatial relationship. Sixty-seven percent of the children (N=8) responded correctly at the practice activities. Child # 1 (the one in the low ability group) had difficulty in identifying all four spatial relationships. The responses from

Child # 11 to the practice activity questions were all wrong. Two other children responded incorrectly to the practice questions at one point or the other. After using the program, these children were asked to recognize the four words with the same flash cards as used before. The result showed that these children were at different stages of letter recognition. Child #12 picked up the concepts of "in front" and "behind." He was able to recognize the words and demonstrate his understanding of the spatial relationship using two pieces of paper. A few picked up the words "in" and "up" and some children tried their best to recognize the letters in the words. For example, a girl responded "n" when shown the word "in" and "p" when shown the word "up." A number of the children, though they responded correctly to the questions at the practice, could not recognize the words after the use of the program. It was interesting to note that, when these children were asked to recognize the words using the flash cards, four children repeated the sentences directly from the computer program. For example, they responded "the elephant's trunk is up" when shown the flash card "up." In other words, they were able to respond with the correct sentence, but were not able to distinguish words from sentences. Two children were able to point to the correct pictures when asked to recognize the words.

**Teachers' Comments**

The two teachers interviewed considered the use of computers in early childhood as fun for the children. They commented that, as computers are becoming more important, it is important for children to know them. They also pointed out that they wished they had a computer in the classrooms and they wished they knew how to use it. That was the main reason they were very supportive of this study. These teachers were also asked to review the observation transcripts to check if the data were consistent with their observations of these children. They thought that the observational data on mouse movement and body movement of these children were consistent with their observation of these children's motor skills. The teachers said that the verbal expressions and facial expressions reflected the personalities of these children. That is, some children were very verbal while others tended to be shy. They

also pointed out that normally they organized activities that required sitting at a 15- to 20-minute block and allowed children to move around, as children of this age had very short attention span. They were pleased to see that the computer could engage the children at a relatively longer time without seemingly getting them bored. They mentioned that several children talked about the computer program with the other children when they got back to the classroom. They said, "it was cool."

## Discussion

### Interactive Multimedia and Learning

The results showed the average time spent in using the program ranged from 24.17 minutes to 35 minutes across three ability groups, longer than what was normally required for an organized sitting activity with this age group. Except for child #11, all children were able to concentrate on the program for most of the time and did not seem to get bored. There was no indication they were anxious to leave at the end of using the program. One child wanted to work on more activities when he finished the assigned ones. This finding supports the existing literature which indicates technology, with the use of various media and interaction, might increase the attention span of young children (Clements & Nastasi, 1993; King & Alloway, 1992; Shade, Nida, Lipinski, & Watson, 1986; Wright & Shade, 1994).

Children's liking of the program, especially its use of video and color graphics, was obvious. Their various verbal and facial expressions, body movement, and responses to the attitudinal questions suggested that they were apparently enjoying themselves during the use. Using the program aroused some children's curiosity as indicated by the data on verbal expressions. Two children were so eager to use the program that their teachers had to call the parents to get permission. All participating children were interested in using a similar program again. These are indications that children are motivated and interactive multimedia can be another fun way to get children interested in learning.

The findings also showed that the use of the program helped only a few children to actually learn the words. Many children were still not able to recognize the words after using

the program. A possible explanation for this result is that children were engaged in the use for a very brief period. Extended and repeated use is necessary to enhance learning. The primary goal of this study was not to increase the children's performance, but to understand how they used the interactive multimedia. Besides being interested in using the technology, that a few children picked up the words and letters after using it, and a couple could identify the correct spatial relationships through gestures is encouraging.

**Interactive Multimedia and Developmental Appropriateness**

Consistent with the research that children as young as preschoolers experienced greatest efficiency in using the mouse (Alloway, 1994), this study found that, regardless of their age and ability levels, these children were able to use the mouse physically. It is remarkable that those who had no prior computer knowledge were able to use the mouse with the "correct" holding position almost immediately. Most of the children were able to move the mouse and click on the buttons with little difficulty. A boy (child #9) even lifted the mouse intuitively when he ran out of the desk space in moving the mouse. Several children showed their excitement while using mouse, and others showed triumph when they felt they "conquered" the use of mouse. Causing an action to happen through clicking appeared to arouse children's curiosity and provide challenges as well as satisfaction for their own actions.

The children, except child # 11, had no problem in switching their attention between the TV monitor and the computer screen at the signal from the videodisc player. The interactive videodisc program used HyperCard color tools and had full-color graphics on every screen. It was slow in loading graphics when it transited from one card to the other. During their use of the program, the children were told that the blinking cursor was an indication that the computer was working and they had to wait a little before clicking. Surprisingly, many children understood this very well. Except for three who kept on clicking before the next screen came up, the majority of the children patiently waited for the next screen and then clicked to proceed. During the process, the observer reminded the children

that the computer was still working. Several children pointed to the blinking cursor and said "I know." It was obvious they understood the instruction. Two boys who had used computers before were used to double-clicking a mouse. They used double-clicking at first. When they were told that they only needed to click once in this program, they quickly adjusted and proceeded independently.

Nothing found in this study shows that age difference is a factor in the pre-kindergarten children' readiness for using the technology mentally or physically. On the other hand, the ability levels (as defined by the teachers of the children) seem to have an impact on the extent the children were able to make connections between what they saw on the computer and TV screens and what they clicked. The girl in the low ability level had a hard time in getting used to the technology and making the connections. However, the differences between the medium and high ability levels are not obvious.

These findings indicate that children as young as three are ready for interactive multimedia technology. It is important, though, to point out that, while we encourage children to learn independently, the role of teachers cannot be underestimated. As it is shown in this study, providing necessary guidance and facilitation is essential for young learners. Although computers can engage children, teachers must be present to answer questions and ready to assist.

**Interactive Multimedia and Its Design Considerations**

Embedding new concepts in a familiar context can increase children's attention span and arouse their interests. In line with the research that shows it is important to use materials that children are familiar with (Clements & Nastasi, 1993), this study showed that the children were excited to see something they already knew the Jungle Book and its characters Bagheera and Mowgli. Their attention was drawn to the content through video, voice, music, and color graphics. Presenting information in an interesting and fun way is important for young children. The results have also indicated that video, audio, music, and color pictures are essential for motivating young children. Interactive multimedia can assist children's

development by helping to exercise their hearing and seeing senses and presenting real-world representations with which children can identify.

Audio proves to be especially essential for non-readers. The instruction and feedback in the program were provided orally upon a mouse click. However, from time to time, children needed prompts from the observer and elicited responses from the observer to confirm their actions. It would have been more helpful to have audio provided without a mouseclick from the user. For example, if a program is idle, a voice could prompt a child to do something. When a child clicks to go to the next card, a voice can prompt the child to act. In this way, audio can help children to get used to the program more quickly.

Interactivity in computer-based instruction is a critical factor to enhance learning and develop autonomy (Davidson & Wright, 1994). This study shows that giving children control and allowing them to determine what to select and for how many times can not only help accommodate different needs and levels of readiness, but also keep them motivated and on task. Clicking and making things happen seem to be a challenge as well as a joy to many children. High-level interactivity in computers can provide another means for children to be in charge and pursue active learning (Wright & Shade, 1994).

The buttons were originally designed to be big, occupying about one-fourth of the screen. This size proves to be appropriate for the pre-kindergartners whose motor skills have not been fully developed. A larger mouse pad and a larger table area might be helpful in providing more space for young children to move their mouse while getting used to the computer. Although the majority of the children have little difficulty in using the mouse for the first time, their intuitive touch screen gesture has shown that touch screen technology is probably easier for the young learners and could possibly accommodate more learners with different needs.

One of the important factors to consider in repurposing a videodisc is to ensure that a video clip is not too long so as to engage a user actively. In this program, most of the video clips were about 15- to 30- seconds long. However, there was one 8-second video clip that

the young learners found too short and ending abruptly. To provide enough context for the young children to comprehend, longer video clips seem necessary. The result of this study suggests that video clips of 25 to 30 seconds long are optimal for young children.

## Conclusions

The integration of various media and focus on interaction in interactive multimedia can provide a playful learning environment with closer representations to the world that young children are familiar with. With interactive multimedia becoming more and more popular in schools, understanding how children use the technology is important. This study provides some insights into how three- to five-year olds use an interactive multimedia program. Children's use will help us gain an understanding of multimedia software design. Such an understanding is critical not only for professional software designers, but also for teachers who begin to develop their own computer programs for use in early childhood curriculum. Clements said that "the effectiveness of computer learning depends critically on the quality of the software, the amount of time children work with the software, and the way in which they use it" (1994, p. 33). The success of using technology relies on teachers' creative and appropriate use of computers in their curriculum. Teachers who use or intend to use technology in their classrooms must have a good understanding of how children use computers. "Good teachers of young children are astute observers of what children do and how they learn" (Morgan & Shade, 1994). Children's use of interactive multimedia is a new exciting area. More research is needed to provide a better understanding of the potentials of technology for enhancing early learning.

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Figure 1. Instructional Card

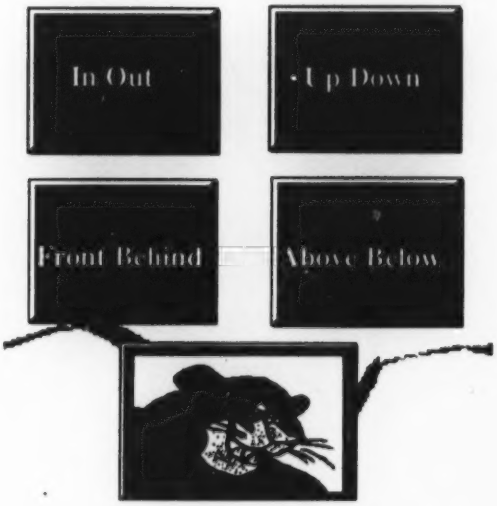


Figure 2. Main Menu

Figure 3. Illustrating the Concept of "Up" Using the Video Clips from The Jungle Book.

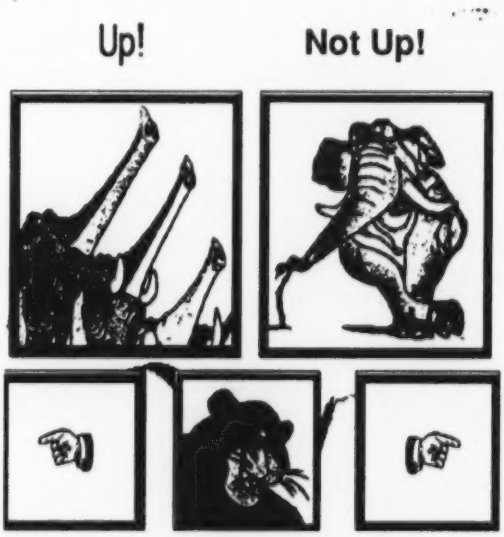


Figure 4. The Practice Activity for "Up"



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Table 1
Time Spent by Age and Ability Levels

| Participants (in ability level) | Gender | Age (YR:MO) | Time Spent | Average Time (within the level) |
|---|---|---|---|---|
| ***Low*** | | | | |
| Child #1 | girl | 4:8 | 35 minutes | 35 min. |
| ***Medium*** | | | | |
| Child #2 | boy | 4:11 | 30 minutes | 28 min. |
| Child #3 | boy | 3:4 | 29 minutes | |
| Child #4 | girl | 4:9 | 30 minutes | |
| Child #5 | girl | 4:9 | 20 minutes | |
| Child #6 | girl | 3:5 | 31 minutes | |
| ***High*** | | | | |
| Child #7 | girl | 5:1 | 25 minutes | 24.17 min. |
| Child #8 | girl | 4:8 | 30 minutes | |
| Child #9 | boy | 5 | 25 minutes | |
| Child #10 | girl | 4 | 25 minutes | |
| Child #11 | boy | 4:1 | 20 minutes | |
| Child #12 | boy | 4:11 | 20 minutes | |

Table 2
A Summary of the Verbal Expressions Children Made.

| **Observation** | **Examples** |
|---|---|
| • Recognizing the story immediately | • " I have seen this movie!"<br>• "I have it at home!"<br>• "I have seen this before. I like the baby." |
| • Expressing various forms of understanding as to how to proceed | • "You mean [to] push here" (pointing to a button.)<br>• smile, pointing her finger to the button.<br>• (pointing the mouse onto a button), "click it?"<br>• "Yeah," (pointing to the button).<br>• nodding, proceeded to click.<br>• "I have to move it" (referring to the mouse).<br>• "You have to put the hand (referring to the icon) up there (referring to the screen) and push it."<br>• "You mean move this guy?" (pointing to the mouse). |
| • Gaining confidence in using the program | • "Let's see. There" (moved the mouse and clicked on the button).<br>• "Click on him" (talking to herself and referring to the panther [a correct move]).<br>• "Get it out of there. There" (talking to himself and referring to move the mouse onto the correct button).<br>• "I just keep going?"<br>• "I pushed it!" (sounding triumph).<br>• "That's easy." |
| • Showing their likeness of program | • "That is neat" (after clicking and a movie started to the play).<br>• "I liked to watch it again. That is funny" (referring to a movie clip).<br>• "That looks funny. I want to watch again."<br>• "I like to watch (the movie)." |
| • Being curious and asking questions | • "Why is the baby with [the] wolf?"<br>• "The boy is up the tree. What is he doing?"<br>• "How come you call it a mouse?"(referring to the mouse for the computer) |
| • Not understanding that clicking on the same button would play the same video clip | • "I have seen this movie."<br>• "I want to watch a different one."<br>• "Oh, man. we already did this one." |
| • Expressing their frustration at the video clips, as the clips appeared to be too short | • "Oh, man. What's happening?"<br>• "Why will it always stop?"<br>• "Who is that" (referring to a character appeared toward the end of the scene). |
| • Being absent-minded | • Upon hearing some noise outside the room, "What is that noise?"<br>• "I can hear the telephone." |

Table 3
The Use of Mouse Among Children Who Had No Prior Computer Knowledge

| Participants (within the level) | Observation on Mouse Use |
|---|---|
| ***Medium*** | |
| Child #3 | • He used both hands to hold the mouse.<br>• He had some trouble in moving the mouse and clicking at the beginning.<br>• He was quickly getting used to using the mouse. |
| Child #4 | • She got used to the mouse quickly.<br>• She could hold the mouse with the correct position.<br>• She could move the mouse onto a button and click with little difficult. |
| Child #6 | • At the beginning, she could not coordinate her eyes and hand movement simultaneously. She switched between the monitor and her hand several times to locate the cursor.<br>• However, she was quick in understanding the relationship between the mouse movement and the cursor. She then focused the monitor and the cursor while moving her hand.<br>• She could click well with one hand. |
| ***High*** | |
| Child #7 | • She had little trouble in using the mouse from the start. After the first card, she was comfortable in using the mouse and clicking.<br>• She occasionally used both hands to hold the mouse. |
| Child #8 | • She could use the mouse almost from the beginning with the correct holding position.<br>• She could click properly. |
| Child #9 | • He could use the mouse almost from the beginning with the correct holding position.<br>• He could click properly.<br>• At one point, he lifted the mouse (without any prompts) in order to move it onto the right button. |
| Child #10 | • She got used to the mouse quickly.<br>• She could click without much difficulty.<br>• She used both hands and moved the mouse in big movements. |

Table 4
How did children like the program

| Response | Freq. | Percent | Subtotal |
|---|---|---|---|
| ***Like the program?*** (out of 12 children) | | | |
| yes | 12 | 100% | |
| no | 0 | 0 | |
| ***Favorite part?*** (out of 21 different responses) | | | |
| About the story | | | 57% |
| the movie | 6 | 29% | |
| color picture | 3 | 14% | |
| specific characters in story | 3 | 14% | |
| About computers | | | 29% |
| using mouse/clicking | 4 | 19% | |
| using computers | 2 | 10% | |
| All of it | 3 | 14% | 14% |
| ***Will participate again?*** (out of 12 children) | | | |
| yes | 12 | 100% | |
| no | 0 | 0 | |

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